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Lou 13-13

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Hui-Ling Lou et al.
Case: 13-13
Serial No.: 09/390,389
Filing Date: September 3, 1999
Group: 2631
Examiner: Kevin Michael Burd

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Signature: Lissa M. Harbo Date: May 28, 2002

Title: Multiplier-Free Methods and Apparatus for Signal
Processing in a Digital Communication System

TRANSMITTAL OF FORMAL DRAWINGS

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Sir:

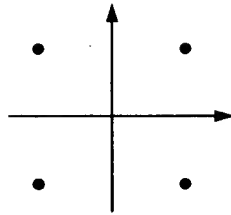
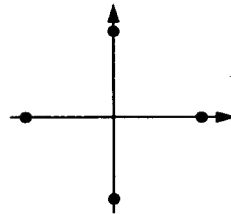
Applicants submit herewith eight (8) sheets of formal drawings in the above-referenced patent application.

Respectfully submitted,

Date: May 28, 2002

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FIG. 1(a)*FIG. 1(b)**FIG. 2*

b_1	b_0	u
0	0	1
0	1	j
1	0	-1
1	1	-j

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FIG. 3

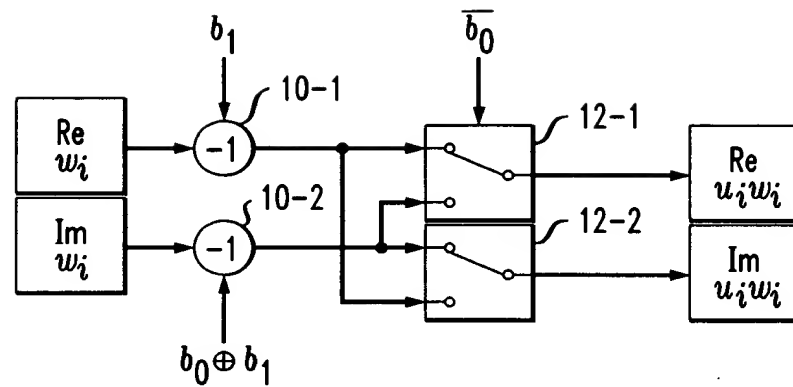


FIG. 4

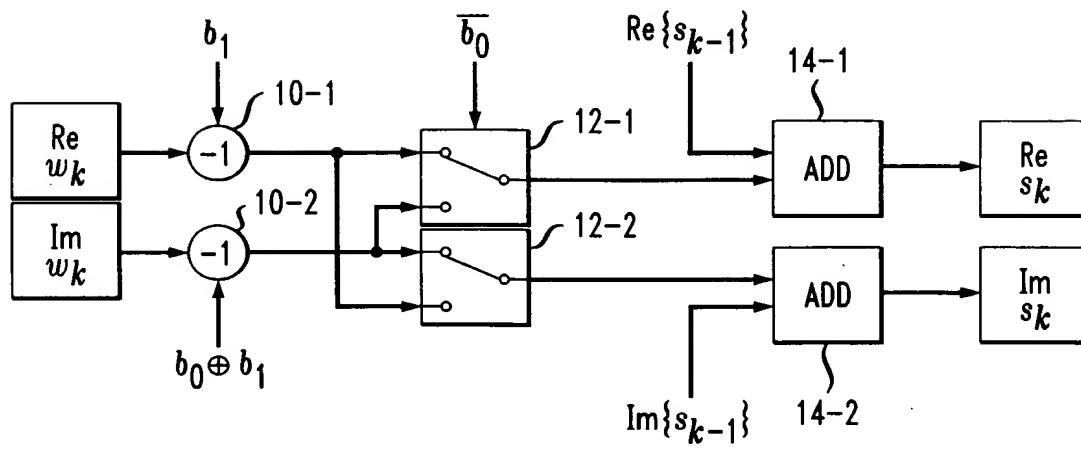


FIG. 5

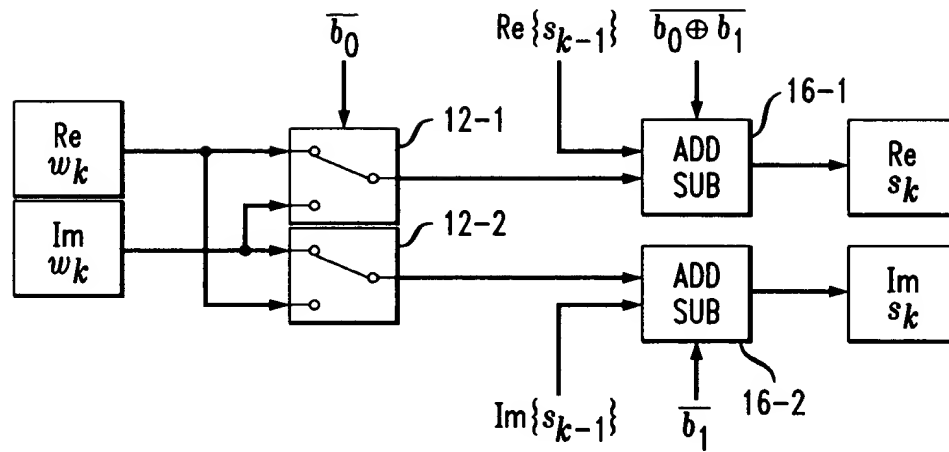


FIG. 6

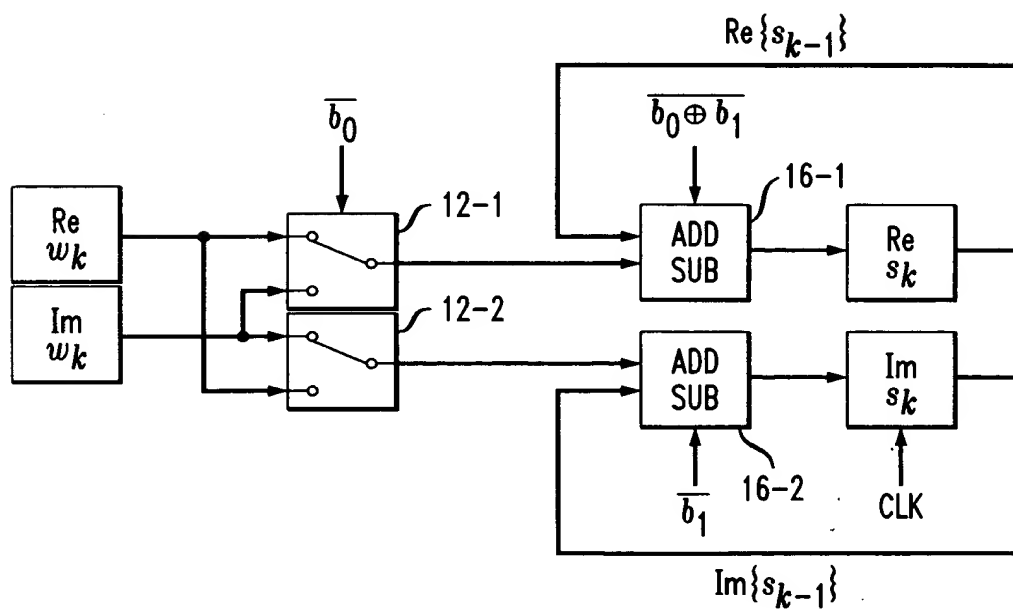


FIG. 7(a)

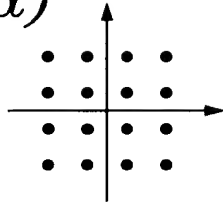


FIG. 7(b)

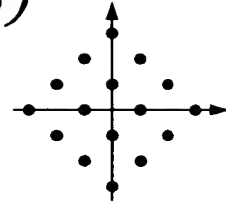


FIG. 7(c)

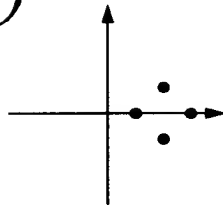


FIG. 7(d)

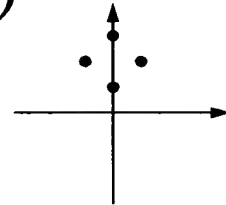


FIG. 7(e)

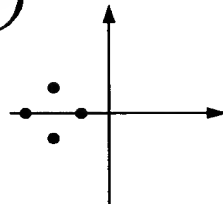


FIG. 7(f)

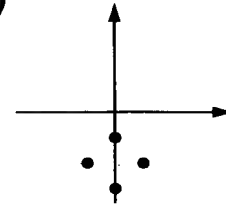
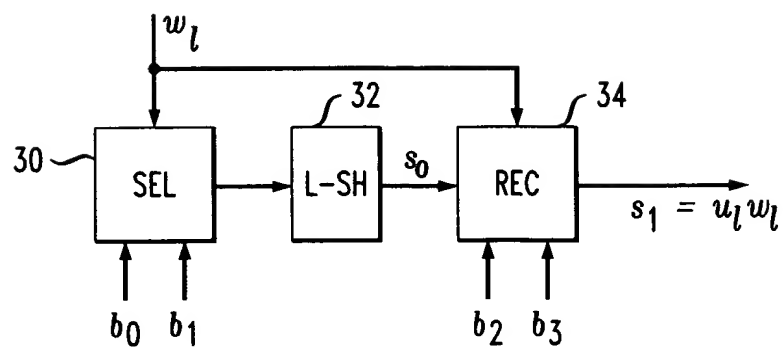


FIG. 8



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FIG. 9

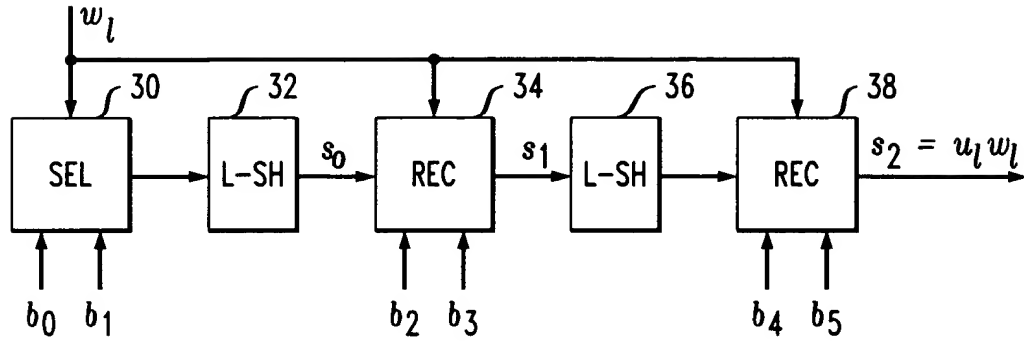
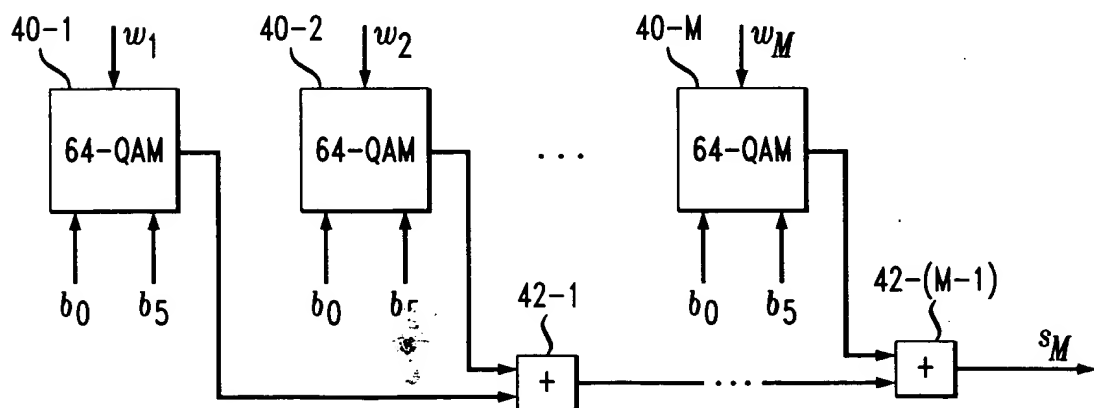


FIG. 10

	SECTION 1.1	CONVENTIONAL
MODULATION	NO. OF ADD/SUB OPERATIONS	NO. OF ADD & MULTIPLY
QPSK	$2M - 2$	$(4M-2) \& 4M$
16-QAM	$3M - 2$	$(4M-2) \& 4M$
64-QAM	$4M - 2$	$(4M-2) \& 4M$
256-QAM	$5M - 2$	$(4M-2) \& 4M$
1024-QAM	$6M - 2$	$(4M-2) \& 4M$

FIG. 11



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FIG. 12

$S(A)$	$S(B)$	op	Z	$S(Z)$
+	+	$A + B$	$A + B$	+
+	-	$A - B$	$A - B$	+
-	+	$B - A$	$B - A$	+
-	-	$-A - B$	$A + B$	-

FIG. 13

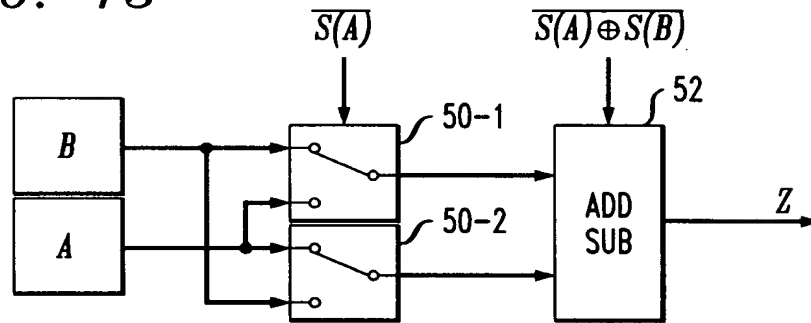
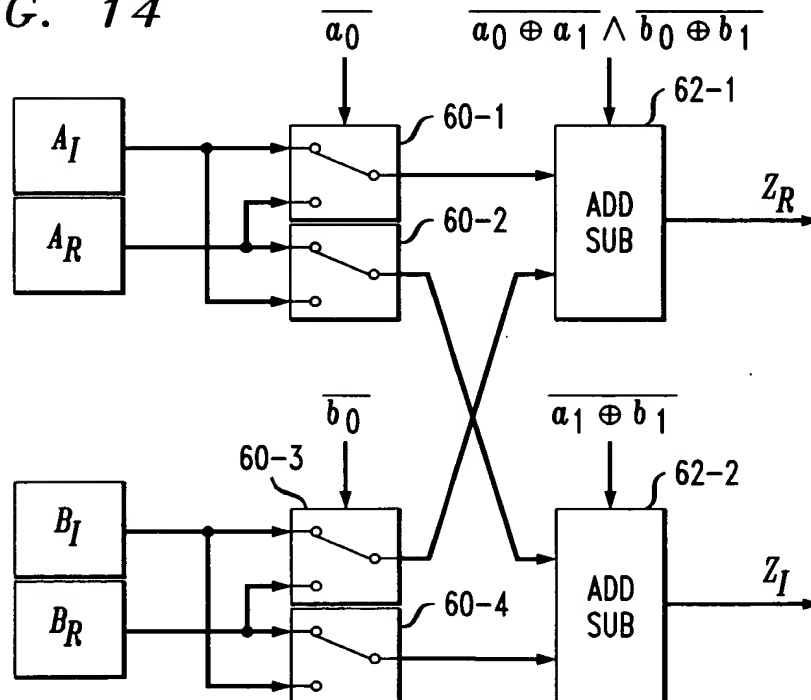


FIG. 14

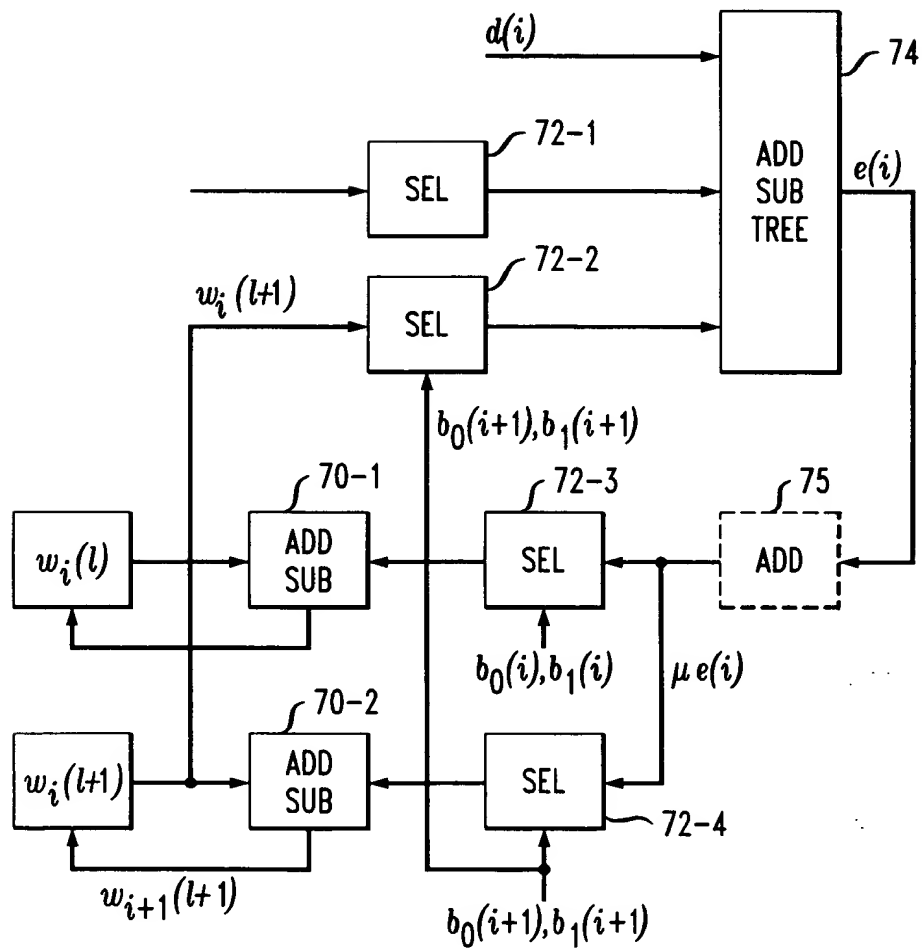


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FIG. 15

MODULATION	COMPLEXITY	MINIMUM LATENCY
QPSK	$4M$	$2 + \log_2 M$
16-QAM	$8M$	$4 + \log_2 M$
64-QAM	$12M$	$6 + \log_2 M$

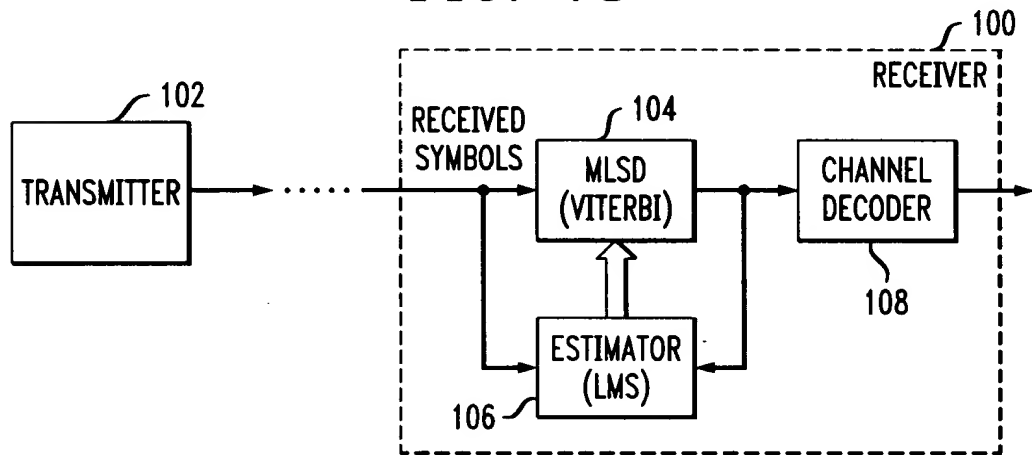
FIG. 16



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FIG. 17

MODULATION	CONVENTIONAL	SECTION 1.1	MINIMAL OPERATIONS (SECTION 1.2)
QPSK	$2 \times 4 = 8$	0	0
16-QAM	$4 \times 16 = 64$	32	14
64-QAM	$4 \times 64 = 256$	160	68

FIG. 18*FIG. 19*